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IS 12316-3-1 (1988): Non-cellulosic Papers for Electrical Purposes, Part 3: Requirements for Individual Materials, Section 1: Unfilled Aramid (Aromatic Polyamide) Papers Calendered [ETD 2: Solid Electrical Insulating Materials and Insulation Systems]

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Indian Standard

**SPECIFICATION FOR
NON-CELLULOSIC PAPERS FOR
ELECTRICAL PURPOSES**

PART 3 REQUIREMENTS FOR INDIVIDUAL MATERIALS

Section 1 Unfilled Aramid (Aromatic Polyamide) Papers Calendered

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Indian Standard

SPECIFICATION FOR NON-CELLULOSIC PAPERS FOR ELECTRICAL PURPOSES

PART 3 REQUIREMENTS FOR INDIVIDUAL MATERIALS**Section 1 Unfilled Aramid (Aromatic Polyamide) Papers Calendered****0. FOREWORD**

0.1 This Indian Standard was adopted by the Bureau of Indian Standards on 22 March 1988, after the draft finalized by the Solid Electrical Insulating Materials Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard (Part 3/Sec 1) is one of the series of Indian Standards which deal with non-cellulosic papers for electrical purposes. This series will have the following three parts:

Part 1 Definitions and general requirements

Part 2 Methods of test

Part 3 Requirements for individual materials

0.3 This standard (Part 3/Sec 1) covers the requirements of aromatic polyamide (nylon) paper, calendered.

0.4 Section 2 of the standard is on aromatic polyamide (nylon) paper, uncalendered.

0.5 Indian Standard specification for cellulosic papers for electrical purposes are covered by IS : 9335*.

0.6 In the preparation of this standard, assistance has been derived from IEC Doc 15C (Central Office) 146, Specification for non-cellulosic papers for electrical purposes : Part 3 Requirements for individual materials, Sheet unfilled aramid papers, issued by the International Electrotechnical Commission.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Cellulosic papers for electrical purposes.

†Rules for rounding numerical values (revised).

1. SCOPE

1.1 This standard (Part 3/Sec 1) covers the requirements for unfilled aramid (aromatic polyamide) paper, calendered.

2. TYPES

2.1 The following types of calendered unfilled aramid paper are covered in this standard:

a) *Type 1* Calendered paper

b) *Type 2* Calendered paper, with improved tearing resistance and conformability

3. GENERAL REQUIREMENTS

3.1 The papers shall satisfy the requirements stated in IS : 12316 (Part 1)-1988*, in addition to those given in Table 1 and Table 2 for Type 1 and Type 2, respectively.

4. SAMPLING

4.1 Sampling procedure shall be in accordance with IS : 1060†.

*Specification for non-cellulosic paper for electrical purposes: Part 1 Definitions and general requirements.

†Methods of sampling and test for paper and allied products.

TABLE 1 REQUIREMENTS FOR TYPE 1 CALENDERED PAPER

(Clause 3)

| PROPERTY | TEST METHOD, REF TO CLAUSE IN IS : 12316 (PART 2)-1988* | UNIT | REQUIREMENTS | TOLERANCE | REMARK |
|------------------|---|-------------------|--|----------------------------|-------------------------|
| (1) Thickness | (2) 3 | (3) μm | (4) Nominal thickness of paper ≤50 μm ≥50 μm | (5) | (6) |
| Substance | 4 | g/m ² | | ±20 percent ±15 percent | |
| | | | | <i>Min</i> | <i>Max</i> |
| | | | 50 | 35 | 46 |
| | | | 80 | 54 | 75 |
| | | | 130 | 100 | 130 |
| | | | 180 | 150 | 200 |
| | | | 250 | 220 | 280 |
| | | | 300 | 270 | 340 |
| | | | 380 | 350 | 430 |
| | | | 510 | 490 | 600 |
| | | | 610 | 630 | 750 |
| | | | 750 | 750 | 910 |
| Apparent density | 5 | g/cm ³ | Nominal thickness μm | <i>Min</i> | <i>Max</i> |
| | | | 50 | 0.64 | 0.88 |
| | | | 80 | 0.71 | 0.97 |
| | | | 130 | 0.79 | 1.02 |
| | | | 180 | 0.87 | 1.09 |
| | | | 250 | 0.88 | 1.08 |
| | | | 300 | 0.92 | 1.10 |
| | | | 380 | 0.93 | 1.13 |
| | | | 510 | 0.97 | 1.17 |
| | | | 610 | 1.04 | 1.26 |
| | | | 750 | 1.00 | 1.25 |
| Tensile strength | 6 | kN/m | Nominal width thickness μm | Machine direc- tion | Cross direc- tion |
| | | | 50 | 2.8 | 1.4 |
| | | | 80 | 4.7 | 2.2 |
| | | | 130 | 9.5 | 5.2 |
| | | | 180 | 16.0 | 8.5 |
| | | | 250 | 22.0 | 12.0 |
| | | | 300 | 30.0 | 17.0 |
| | | | 380 | 36.0 | 22.0 |
| | | | 510 | 52.0 | 30.0 |
| | | | 610 | 63.0 | 36.0 |
| | | | 750 | 79.0 | 47.0 |
| Elongation | 6 | Percent | Nominal thickness | MD | CD |
| | | | 50 | 6 | 5 |
| | | | 80 | 7 | 6 |
| | | | 130 | 11 | 9 |
| | | | 180 | 13 | 11 |
| | | | 250 | 13 | 11 |
| | | | 300 | 13 | 12 |
| | | | 380 | 13 | 12 |
| | | | 510 | 13 | 12 |
| | | | 610 | 13 | 12 |
| | | | 750 | 13 | 10 |

*Specification for non-cellulosic papers for electrical purposes: Part 2 Methods of test.

(Continued)

TABLE 1 REQUIREMENTS FOR TYPE 1 CALENDERED PAPER — *Contd*

| PROPERTY | TEST METHOD, REF TO CLAUSE IN IS : 12316 (PART 2)-1988* | UNIT | REQUIREMENTS | | TOLERANCE | REMARK |
|------------------------------|---|---------|--------------------------------|--------------------------|------------------------|--------------------------|
| (1) Edge tearing strength | (2) 8 | N | (3) Nominal thickness μm | (4) Machine direction | (5) Cross direction | (6) Minimum specified |
| | | | 50 | 48 | 24 | |
| | | | 80 | 100 | 44 | |
| | | | 130 | 200 | 80 | |
| | | | 180 | 300 | 130 | |
| | | | 250 | 400 | 160 | |
| | | | 300 | 460 | 180 | |
| | | | 380 | 480 | 180 | |
| | | | 510 | 520 | 200 | |
| | | | 610 | 520 | 240 | |
| | | | 750 | 640 | 240 | |
| Electric strength | 10 | kV/mm | Nominal thickness μm | Machine direction | Minimum specified | |
| | | | 50 | 15 | | |
| | | | 80 | 18 | | |
| | | | 130 | 21 | | |
| | | | 180 | 27 | | |
| | | | 250 | 27 | | |
| | | | 300 | 27 | | |
| | | | 380 | 25 | | |
| | | | 510 | 25 | | |
| | | | 610 | 23 | | |
| | | | 750 | 21 | | |
| Shrinkage on heating | 11 | Percent | Nominal thickness μm | Machine direction | Cross direction | Maximum specified |
| | | | 50 | 4.0 | 2.0 | |
| | | | 80 | 3.0 | 2.0 | |
| | | | 130 | 2.0 | 2.0 | |
| | | | 180 | 2.0 | 2.0 | |
| | | | 250 | 2.0 | 2.0 | |
| | | | 300 | 2.0 | 2.0 | |
| | | | 380 | 2.0 | 2.0 | |
| | | | 510 | 1.5 | 1.5 | |
| | | | 610 | 1.5 | 1.5 | |
| | | | 750 | 1.5 | 1.5 | |

*Specification for non-cellulosic papers for electrical purposes: Part 2 Methods of test.

TABLE 2 REQUIREMENTS FOR TYPE 2 CALENDERED PAPER
(Clause 3)

| PROPERTY | TEST METHOD, REF TO CLAUSE IN IS : 12316 (PART 2)-1988* | UNIT | REQUIREMENTS | | TOLERANCE | REMARK |
|---------------------------------------|---|-------------------------------|--------------------------------------|----------------------------------|-----------|--------|
| (1) Nominal thickness Substance | (2) 3 4 | (3) μm g/m ² | (4) 50 Nominal thickness μm | (5) ±15 percent Min Max | | (6) |
| | | | 180 | 150 | 200 | |
| | | | 250 | 220 | 280 | |
| | | | 300 | 270 | 340 | |
| | | | 380 | 350 | 430 | |
| Apparent density | 5 | g/cm ³ | 180 | 0.85 | 1.07 | |
| | | | 250 | 0.85 | 1.09 | |
| | | | 300 | 0.85 | 1.09 | |
| | | | 380 | 0.85 | 1.09 | |

*Specification for non-cellulosic papers for electrical purposes: Part 2 Methods of test.

(*Continued*)

TABLE 2 REQUIREMENTS FOR TYPE 2 CALENDERED PAPER — *Contd*

| PROPERTY | TEST METHOD, REF TO CLAUSE IN IS : 12316 (PART 2)-1988* | UNIT | REQUIREMENTS | | TOLERANCE | REMARK |
|-------------------------|---|----------------------|----------------------------|---------------------------|-------------------------|-----------------------------|
| (1) Tensile strength | (2) 6 | (3) kN/m width | Nominal thickness μm | Machine direc- tion | Cross direc- tion | (5) Minimum specified |
| | | 180 | 11·0 | 5·5 | | |
| | | 250 | 19·0 | 8·5 | | |
| | | 300 | 24·0 | 11·0 | | |
| | | 380 | 27·0 | 14·0 | | |
| Elongation | 6 | Percent | 180 | 7 | 7 | Minimum specified |
| | | | 250 | 11 | 11 | |
| | | | 300 | 11 | 11 | |
| | | | 380 | 11 | 11 | |
| Edge tearing strength | 8 | N | 180 | 320 | 160 | Minimum specified |
| | | | 250 | 520 | 280 | |
| | | | 300 | 600 | 300 | |
| | | | 380 | 800 | 440 | |
| Electric strength | 10 | kV/mm | Nominal thickness μm | Machine direc- tion | | Minimum specified |
| | | | 180 | 25 | | |
| | | | 250 | 25 | | |
| | | | 300 | 25 | | |
| | | | 380 | 23 | | |
| Shrinkage on heating | 11 | Percent | Nominal thickness μm | Machine direc- tion | Cross direc- tion | Maximum specified |
| | | | 180 | 3·0 | 3·0 | |
| | | | 250 | 3·0 | 3·0 | |
| | | | 300 | 3·0 | 3·0 | |
| | | | 380 | 3·0 | 3·0 | |

*Specification for non-cellulosic papers for electrical purposes: Part 2 Methods of test.

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